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1123

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 1123

Washington, D. C. ▼ November 6, 1922

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PROPORTIONING THE INGREDIENTS FOR ICE CREAM AND OTHER FROZEN PRODUCTS BY THE BALANCE METHOD.[1]

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CONTENTS.

	Page.
The balance method	1
Five basic conditions	2
How the ingredients are proportioned	2
Examples 1 to 5	2
Rough estimates for proportioning ingredients	10
Adjustment of composition	11

THE BALANCE METHOD.

One of the most satisfactory methods that can be used for proportioning the ingredients in making large ice-cream mixes is "the balance method," a term originated in connection with the work here reported. It is a method that can be easily understood, is applicable to all combinations of ingredients, and reduces to a minimum the chances of error in the calculations. Furthermore, it furnishes an itemized record of the ingredients used for each mix. In the examples given, the calculations include decimal fractions, but for all practical trade purposes the nearest whole number is sufficiently accurate, especially when they represent constituents amounting to 100 pounds or more. The proportions obtained by this method are based on five conditions:

1. The amount (pounds) of mix that will be necessary to produce the number of gallons of ice cream desired.
2. The composition (standard) of ice cream desired.
3. The amount of solid constituents necessary for the mix.
4. The quantity and physical condition of the ingredients on hand.
5. The composition of the ingredients to be used.

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[1] This bulletin is a technical discussion of a method of calculating mixes of ice cream and other frozen products. It should not be construed as recommending the formulas presented, for not all of them would be legal in all States. Each user should give consideration to the legal standards concerned.

Part of the material in this bulletin was first published in the Journal of Dairy Science, Vol. III, No. 6, November, 1920.

FIVE BASIC CONDITIONS.

Condition 1.—To get the total number of pounds in the mix, multiply the desired number of gallons of ice cream by the number of pounds expected in one gallon of the finished product. For instance, in the first example 5 pounds is the desired weight of one gallon of ice cream, hence:

$$350 \times 5 = 1{,}750 \text{ pounds of mix.}$$

Condition 2.—The approximate composition of the ice cream desired in the first example is 14.5 per cent fat, 14 per cent sugar, and 6.5 per cent milk solids not fat.

Condition 3.—To find the amount of solid constituents necessary, multiply the pounds of mix by the percentage of fat, sugar, and milk solids not fat as in the first example:

$$1{,}750 \times 0.145 = 253.75 \text{ pounds of fat.}$$
$$1{,}750 \times 0.14 = 245.0 \text{ pounds of sugar.}$$
$$1{,}750 \times 0.065 = 113.75 \text{ pounds of milk solids not fat.}$$

Conditions 4 and 5.—The quantity on hand and composition of the ingredients are as follows:

Ingredients.	Quantity on hand.	Composition.		
		Fat.	Sugar.	Milk solids not fat.
		Per cent.	*Per cent.*	*Per cent.*
Cream	150 pounds	28		6.4
Cream	Plenty	43		5.3
Skim milk	do			9
Condensed milk	430 pounds	10	42	22

After these basic conditions are determined, write the pounds of mix, the percentage of constituents desired, and the pounds of each constituent in table form and list the ingredients to be considered for the mix as shown in Table 1.

HOW THE INGREDIENTS ARE PROPORTIONED.

Five examples of this method of proportioning the ingredients are explained as follows:

EXAMPLE 1.

Give the proportions for 350 gallons of ice cream testing approximately 14.5 per cent fat, 14 per cent sugar, and 6.5 per cent milk solids not fat. The weight of the ice cream desired is 5 pounds per gallon.

Stock on hand: Sugar; 150 pounds of 28 per cent cream; 520 pounds of 43 per cent cream; and skim milk.

TABLE 1.—*Illustration of Example 1.*

Total pounds desired (5×350=1,750).	Ingredients and composition.	Constituents furnished.		
		Fats (14.5 per cent, 253.75 pounds).	Sugar (14 per cent, 245 pounds).	Milk solids not fat (6.5 per cent, 113.7 pounds).
Pounds.		*Pounds.*	*Pounds.*	*Pounds.*
245. 0	Sugar		245	
150. 0	Cream, 28 per cent	42. 00		[1] 10. 0
492. 5	Cream, 43 per cent	211. 77		[1] 26. 1
862. 5	Skim milk, 9 per cent			77. 6
1, 750. 0		253. 77	245	[2] 113. 7

[1] The amount of milk solids not fat in the cream is determined by multiplying the difference between the amount of cream used and the amount of fat it contains by 0.093 (the amount of milk solids not fat in the milk serum).

[2] The amount of milk solids not fat in the mix is normal, i. e., the amount resulting from the use of sugar, cream, and whole or skim milk; consequently the figures given in this example are simply to explain a procedure that is applicable to the use of other milk products, such as butter, condensed milk, etc., and are not intended to satisfy the particular requirement of 6.5 per cent, which may vary according to the milk-solids-not-fat content of the skim milk.

METHOD OF CALCULATING THE INGREDIENTS.

The calculations necessary in determining the proportions of the ingredients to be used are as follows (consider the ingredients as they are listed):

Sugar.—The amount of sugar is the same as the amount calculated for the mix, since there is no cane sugar in the other ingredients.

Cream (*28 per cent*).—The 150 pounds of 28 per cent cream does not contain more fat than is needed; hence the entire amount can be used.

Cream (*43 per cent*).—The amount of 43 per cent cream can be determined by subtracting the amount of fat added by the 150 pounds of 28 per cent cream from the total amount required and dividing the remainder by 0.43, thus:

$253.77-42=211.77.$

$211.77\div0.43=492.5$ pounds of 43 per cent cream.

Skim milk.—From this ingredient will come the remainder of the constituents (milk solids not fat) of the mix. The amount required will be the difference between the amount of ingredients already used and the total (1,750) pounds required. For instance, $1{,}750-(245+150+492.5)=862.5$ pounds of skim milk.

EXAMPLE 2.

Give the proportions for 500 gallons of ice cream testing approximately 14.5 per cent fat, 13 per cent sugar, 9 per cent milk solids not fat, and 0.5 per cent gelatin. The weight of the ice cream desired is 5 pounds per gallon.

Stock on hand: Sugar; gelatin; 342 pounds of 30.5 per cent cream; 1,608 pounds of 38 per cent cream; 720 pounds of sweetened condensed milk containing 8.2 per cent fat, 42 per cent sugar, and 21 per cent milk solids not fat; and skim-milk powder.

TABLE 2.—*Illustration of Example 2.*

Total pounds desired, 5×500= 2,500.	Ingredients and composition.	Constituents furnished.			
		Fat (14.5 per cent, 362.5 pounds).	Sugar (13 per cent, 325 pounds).	Milk solids not fat (9 per cent, 225 pounds).	Gelatin (0.5 per cent, 12.5 pounds).
Pounds.		*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
23.0	Granulated sugar		23.0		
12.5	Gelatin (powdered)				12.5
342.0	Cream, 30.5 per cent	104.3		22.0	
524.0	Cream, 38 per cent	199.0		30.0	
720.0	Condensed milk 8.2 per cent fat, 42 per cent sugar, 21 per cent milk solids not fat	59.0	302.0	151.0	
23.0	Skim-milk powder			22.0	
855.5	Water				
2,500.0		362.3	325.0	225.0	12.5

METHOD OF CALCULATING THE INGREDIENTS.

The calculations necessary in determining the proportions are as follows (consider the ingredients as they are listed):

Granulated sugar.—The amount of granulated sugar can not be determined until the sweetened condensed milk is proportioned.

Gelatin (*powder*).—The amount of gelatin is the same as that calculated for the mix.

Cream.—The 342 pounds of 30.5 per cent cream does not contain more than a small proportion of the fat required; hence the entire amount can be used.

The amount of 38 per cent cream required can not be proportioned until after the condensed milk is proportioned, since the latter contains 8.2 per cent fat.

Sweetened condensed milk.—The amount of sweetened condensed milk that can be used is limited by the amount of sugar and milk solids not fat it adds to the mix. The 720 pounds of sweetened condensed milk will add only 302 pounds of sugar and 151 pounds of milk solids not fat; hence the entire amount can be used.

Granulated sugar.—With the condensed milk proportioned, the amount of granulated sugar necessary can be determined by subtracting the amount added in the condensed milk from the total amount required, thus:

$325-302=23$ pounds of granulated sugar.

Cream (*38 per cent*).—Now that the condensed milk is proportioned, the amount of 38 per cent cream may also be determined. The amount is obtained by subtracting the sum of the fat contained in the 342 pounds of 30.5 per cent cream and the 720 pounds of 8.2 per cent condensed milk from the total amount required and dividing the remainder by 0.38, thus:

$362.5-(104.3+59.0)=199.2.$

$199.2\div 0.38=524$ pounds of 38 per cent cream.

Skim-milk powder.—From this ingredient must come the remainder of the milk solids not fat needed in the mix. This is determined by the difference between the sum of the milk solids not fat added by the cream[2] and condensed milk and the total amount required plus 5 per cent.[3] For instance:

$$225 - (22 + 30 + 151) = 22.$$
$$22 + (0.05 \times 22) = 23.1.$$

Water.—The required amount of solid constituents having been provided, the amount of water needed will be the difference between the total amount of mix required and the sum of the ingredients used.

The accuracy of the calculations can be ascertained by comparing the sum of the figures in each column with the stipulated amounts placed at the top of each column.

When this is done, the ingredients are proportioned by careful weighing. The mix is then ready to be pasteurized and homogenized.

EXAMPLE 3.

Give the proportions for 350 gallons of frozen product testing approximately 9 per cent fat, 14 per cent sugar, 12 per cent milk solids not fat, and 0.5 per cent gelatin. The weight of the product desired is 5 pounds per gallon.

Stock on hand: Sugar; gelatin; 150 pounds of 28 per cent cream, 480 pounds of 34 per cent cream; skim milk; and 900 pounds of condensed skim milk, unsweetened.

TABLE 3.—*Illustration of Example 3.*

Total pounds desired, 1,750.	Ingredients and composition.	Constituents furnished.			
		Fat (9 per cent, 157.6 pounds).	Sugar (14 per cent, 245 pounds).	Milk solids not fat (12 per cent, 210 pounds).	Gelatin (0.5 per cent, 8.75 pounds).
Pounds.		*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
245. 0	Cane sugar		245		
87. 5	Gelatin solution, 10 per cent				8. 75
150. 0	Cream, 28 per cent	42. 0		10. 0	
340. 0	Cream, 34 per cent	115. 6		20. 8	
397. 0	Skim milk, 9 per cent			35. 8	
530. 0	Condensed skim milk, 27 per cent			143. 0	
1,749. 5		157. 6	245	209. 6	8. 75

METHOD OF CALCULATING THE INGREDIENTS.

The calculations necessary in determining the proportions are as follows (consider the ingredients as they are listed):

Sugar.—The amount of sugar is the same as the amount calculated for the mix, since there is no cane sugar in the other ingredients.

Gelatin.—The amount of gelatin solution is determined by moving the decimal point one place to the right, since the solution is a 10 per cent mixture.

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[2] The amount of milk solids not fat in the cream is determined by multiplying the difference between the amount of cream used and the amount of fat it contains by 0.093 (the amount of milk solids not fat in the milk serum).

[3] Skim-milk powder contains on an average 3.5 per cent moisture and 1.5 per cent fat; consequently an allowance of 5 per cent is made in balancing the milk solids not fat.

Cream.—The 150 pounds of 28 per cent cream does not contain more fat than is needed; hence the entire amount can be used.

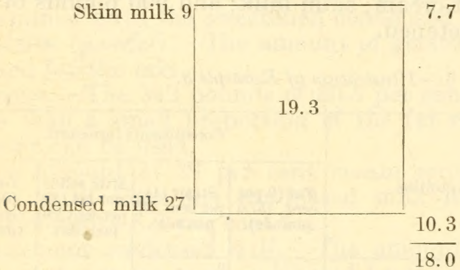
The amount of 34 per cent cream can be determined by subtracting the amount of fat added by the 150 pounds of 28 per cent cream from the total amount required and dividing the remainder by 0.34, thus:

$157.5-42=115.5.$
$115.5\div 0.34=340$ pounds of 34 per cent cream.

Skim milk and condensed skim milk.—From these two ingredients must come the balance of the constituents (milk solids not fat) of the mix. To find the proportions subtract the sum of the milk solids not fat in the cream from the total amount required and divide by 927.5, the difference between the amount of ingredients already used and the total (1,750) pounds required. For instance:

$210-(10+20.8)=179.2.$
$(179.2\div 927.5)\times 100=19.3$ per cent solids.

This gives the per cent of solids not fat that the additional 927.5 pounds of mix must contain. To find the proportion of skim milk and condensed skim milk necessary, the "square method" is used. The calculations for the square method [4] are as follows:



$927.5\div 18=51.53$ number of unit portions in total mix.
$51.53\times 7.7=396.78$ pounds of skim milk in total mix.
$51.53\times 10.3=530.75$ pounds of condensed skim milk in total mix.

The accuracy of the calculation can be ascertained by comparing the sum of the figures in each column with the stipulated amounts placed at the top of each column.

When this is done, the ingredients are proportioned by careful weighing. The mix is then ready to be pasteurized and homogenized.

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[4] The square method, sometimes called the Pearson method, may be used to find the proportion of milk and cream necessary in standardizing either the fat or the milk solids not fat in milk and cream. The purpose of the square is to separate the three principal factors in making the calculations, and to keep the deductions straight after the calculations have been made. For instance, in this particular problem, which is to find the proportion of skim milk and condensed skim milk necessary in making 927.5 pounds of skim milk containing 19.3 per cent milk solids not fat, the three principal factors are: First, the milk solids not fat content desired in the mixture; second, the milk solids not fat content of the skim milk; and third, the milk solids not fat content of the condensed skim milk. The first factor (19.3 per cent) is placed in the center of the square; and the other two factors (9 per cent and 27 per cent) are assigned to the corners on the left-hand side of the square. When this has been done, two calculations are made and placed as follows: (1) The difference between the upper left-hand figure (9) and the center figure (19.3), which is 10.3, is placed in the lower right-hand corner of the square, and indicates the number of pounds in a unit portion of the condensed skim milk required in the proposed mixture. Similarly the difference between the lower left-hand figure (27) and the center figure (19.3) which is 7.7, is placed in the upper right-hand corner of the square, and indicates the number of pounds in a unit portion of the skim milk required in the proposed mixture. Having ascertained the weight of one unit portion of each of these ingredients, any quantity of the desired mixture can easily be made by adding these two together to find the weight of one unit portion of the mixture desired, and then multiplying this by the number of unit portions in the total mix, as shown in the above example. The same procedure is used in standardizing the fat contents of milk and cream.

EXAMPLE 4.

Give the proportions of the following ingredients necessary for 280 gallons of a frozen product testing approximately 10 per cent fat, 8 per cent sugar, and the equivalent of 6 per cent additional sugar in the form of maltose sugar sirup and corn sirup,[5] 10 per cent milk solids not fat, and 0.5 per cent gelatin. The weight of the product desired is 4.5 pounds per gallon.

Stock on hand: Sugar; gelatin; maltose sugar sirup and corn sirup; cream (221 pounds of 40 per cent, 80 pounds of 35 per cent, 82 pounds of 24 per cent, 78 pounds of 29.5 per cent, 64 pounds of 28 per cent, and 73 pounds of 19 per cent); sweetened condensed skim milk testing 25 per cent milk solids not fat and 40 per cent sugar; and skim milk powder.

TABLE 4.—*Illustration of Example 4.*

Total pounds desired, 1,260.	Ingredients and composition.	Constituents furnished.			
		Fat (10 per cent, 126 pounds).	Sugar (8 per cent, 101 pounds).	Milk solids not fat (10 per cent, 126 pounds).	Gelatin (0.5 per cent, 6.3 pounds).
Pounds.		*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
	Granulated sugar (cane)				
63.0	Gelatin solution, 10 per cent				6.3
151.0	Sirup, 80 per cent solids [1]				
80.0	Cream, 35 per cent	28.0		28.8	
82.0	Cream, 24 per cent	19.6			
78.0	Cream, 29.5 per cent	23.0			
64.0	Cream, 28 per cent	17.9			
73.0	Cream, 19 per cent	13.8			
59.0	Cream, 40 per cent	23.6			
252.5	Condensed skim milk, 25 per cent solids and 40 per cent sugar		101.0	63.0	
35.5	Skim-milk powder			34.0	
322.0	Water				
1,260.0		125.9	101.0	125.8	6.3

[1] The solids in the sirup weigh about 121 pounds.

METHOD OF CALCULATING THE INGREDIENTS.

The calculations necessary in determining the proportions are as follows (consider the ingredients as they are listed):

Granulated sugar.—The amount of granulated sugar can not be determined until the sweetened condensed milk is proportioned.

Gelatin.—The amount of gelatin solution is determined, as in Example 3, by moving the decimal point one place to the right, since the solution contains 10 per cent of gelatin.

Sirups.—The amount of sirup is determined by multiplying 1,260 by the per cent desired, thus:

1,260 × 0.12 = 151.2 pounds of sirup.

Cream.—Since all the different lots of cream are used except the lot testing 40 per cent, the sum of the first five lots will add 102.3 pounds of fat to the mix and the remainder is determined by dividing the difference between 126 pounds and 102.3 pounds by the per cent of fat in the sixth lot, thus:

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[5] Maltose sugar sirup and corn sirup are only half as sweet as cane sugar; consequently to replace the 6 per cent sugar it is necessary to use 12 per cent sirup.

$$126.0-(28+19.6+23+17.9+13.8)=23.6.$$
$$23.6\div 0.40=59.0 \text{ pounds of 40 per cent cream.}$$

Sweetened condensed skim milk.—The amount of sweetened condensed skim milk that can be used is limited by the amount of sugar it will add to the mix. Dividing the amount of sugar needed in the mix by the per cent of sugar in the sweetened condensed skim milk will give the amount of this milk that can be used, thus:

$$101\div 0.40=252.5 \text{ pounds of sweetened condensed skim milk.}$$

Granulated sugar.—Since the required amount of sugar is added with the sweetened condensed milk, no granulated sugar is needed.

Skim-milk powder.—The amount of skim-milk powder is determined by subtracting the sum of the milk solids not fat added by the cream[6] and the condensed milk from the total amount required and adding 5 per cent,[7] thus:

$$126-(28.8+63)=34.2.$$
$$34.2+(34.2\times 0.05)=35.9.$$

Water.—The required amount of solid constituents having been added, the amount of water needed will be the difference between the total amount of the mix required and the sum of the ingredients used.

The accuracy of the calculations can be ascertained by comparing the sum of the figures in each column with the stipulated amounts placed at the top of each column.

When this has been done the ingredients are proportioned by careful weighing. The mix is then ready to be pasteurized and homogenized.

EXAMPLE 5.

Give the proportions for 220 gallons of a frozen product testing approximately 10 per cent fat, 14 per cent sugar, 10 per cent milk solids not fat, and 0.5 per cent gelatin. The weight of the product desired is 4.5 pounds per gallon.

Stock on hand: Sugar; gelatin; cream, 33 per cent; condensed milk testing 10 per cent fat and 22 per cent milk solids not fat; and whole milk testing 3.6 per cent fat.

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[6] The amount of milk solids not fat in the cream is determined by multiplying the difference between the amount of cream used and the amount of fat it contains by 0.093.

[7] Skim-milk powder contains, on an average, 3.5 per cent moisture and 1.5 per cent fat; consequently an allowance of 5 per cent is made in balancing the milk solids not fat.

TABLE 5.—*Illustration of Example 5.*

Total pounds desired, 4.5×220=990.	Ingredients and composition.	Constituents furnished.			
		Fat (10 per cent, 99 pounds).	Sugar (14 per cent, 138.5 pounds).	Milk solids not fat (10 per cent, 99 pounds).	Gelatin (0.5 per cent, 4.95 pounds).
Pounds.		*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
138. 5	Sugar		138. 5		
49. 5	Gelatin, 10 per cent				4. 95
185. 0	Cream, 33 per cent	61. 0		44. 9	
372. 0	Whole milk, 3.6 per cent	13. 4			
245. 0	Condensed milk, 10 per cent fat, 22 per cent milk solids not fat	24. 5		53. 9	
990. 0		98. 9	138. 5	98. 8	4. 95

METHOD OF CALCULATING THE INGREDIENTS.

The calculations necessary in determining the proportions are as follows (consider the ingredients as they are listed):

Sugar.—The amount of sugar is the same as the amount calculated for the mix, since there is no cane sugar in the other ingredients.

Gelatin.—The amount of gelatin solution is determined by moving the decimal point one place to the right, since the solution is a 10 per cent mixture.

Cream (33 per cent).—The amount of cream can not be proportioned until after the condensed milk is proportioned, since the latter contains 10 per cent fat.

Whole milk (3.6 per cent).—Temporarily omitted for the same reason.

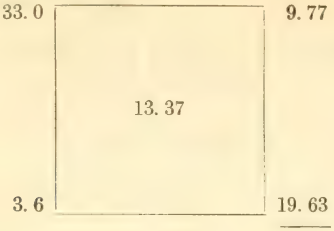
Condensed milk.—The amount of condensed milk necessary in this case is determined by using a rough estimate (see p. 10). From this estimate it is found that 245 pounds is about the correct amount, thus:

$990-(138.5+49.5+245)=557.$
$557-(99-24.5)=482.5.$
$482.5\times0.093=44.87.$
$44.87+53.9=98.77$ pounds of milk solids not fat.

Cream (33 per cent) and whole milk (3.6 per cent).—From these two ingredients must come the remainder of the constituents (fat and solids not fat) of the mix. To find the amount of each, subtract the amount of fat added by the condensed milk from the total amount required and divide by 557, the difference between the amount of ingredients already used, and the total (990) pounds required, thus:

$99-24.5=74.5.$
$74.5\div557\times100=13.37$ per cent in 557 pounds of milk.

This gives the per cent of fat that the additional 557 pounds of mix must contain. To find the proportions of cream and whole milk that are necessary, the square method [8] is used. The calculations for the square method are as follows:



29. 40 total number of parts.

557÷29.4=18.94.
18.94×9.77=185 pounds of cream.
18.94×19.63=372 pounds of whole milk.

The accuracy of the calculations can be ascertained by comparing the sum of the figures in each column with the stipulated amounts placed at the top of each column.

When this has been done the ingredients are proportioned by careful weighing. The mix is then ready to be pasteurized and homogenized.

ROUGH ESTIMATES FOR PROPORTIONING INGREDIENTS.

Whenever a mix is made from an unlimited quantity of condensed whole milk the amount of condensed milk required is determined by first making a rough estimate. For instance, in example 5, it is not known what part of the total amount of milk solids not fat of the mix must come from the condensed milk, so that what is thought to be about the right amount is tried. In this case the figure taken to begin with was 220 pounds. This figure is taken because from experience it is known that about 50 per cent of the milk solids not fat in the mix must come from the condensed milk. That quantity divided by 22 (the per cent of milk solids not fat in the condensed milk) shows that it will require about 220 pounds of the condensed milk. This amount would add 22 pounds of fat and 48.4 pounds of milk solids not fat to the milk.

To tell whether or not this is right simply take the difference between the total amount of ingredients already calculated (that is, the pounds of sugar, gelatin, and condensed milk) and the total weight of the mix, and subtract the difference between the fat used in the condensed milk and the total amount required to find the amount of milk serum. Then multiply this figure by 0.093 to get approximately the amount of milk solids not fat that will come from the milk and cream and the sum of the two will indicate whether the proportions are correct, thus:

990 − (138.5 + 49.5 + 220) = 582 pounds of milk and cream.
582 − (99 − 22) = 505 pounds of milk serum.
505 × 0.093 = 47 pounds of milk solids not fat from serum.
47 + 48.4 = 95.4 pounds of milk solids not fat in mix.

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[8] See p. 6.

The total amount of milk solids not fat lacks about 3.35 pounds, so we increase the amount of condensed milk 25 pounds or to 245 pounds, which gives practically the right amount as shown in the table. In case the quantity had been increased only 15 pounds the total amount of milk solids not fat would have been a trifle short of the amount desired. The amount of milk and cream is then calculated as heretofore explained.

ADJUSTMENT OF COMPOSITION.

After a mix has been made up it frequently happens that the percentage of fat and milk solids not fat in the mix is found to be not as desired. In such cases the composition of the mix can be easily changed to approximate the percentage desired by the addition of water, cream, skim milk, condensed milk, or powdered milk, depending on the nature of the adjustment to be made. Three common adjustments are briefly as follows:

1. CORRECTING A MIX LOW IN FAT.

(*a*) Size of original mix, 3,600 pounds.

(*b*) Desired composition of original mix, fat 12 per cent, sugar 15 per cent, gelatin 0.5 per cent.

(*c*) Fat test of original mix, 11.5 per cent.

(*d*) The difference is 0.5 per cent fat, indicating a shortage of 18 pounds of fat in the mix.

To correct the standardization with cream testing 34 per cent fat, together with sugar and gelatin, increase the size of the mix to 3,800 pounds and calculate the amount of each constituent that is needed in the new mix. Then the difference between the amount of constituents necessary for the new mix and the amounts contained in the original mix furnishes a basis for adjusting the percentage of each constituent desired in the mix. For instance, the difference is 42 pounds of fat, 30 pounds of sugar, and 1 pound of gelatin.

$3{,}800 \times 0.12 = 456$ pounds of fat.
$3{,}600 \times 0.115 = 414$ pounds of fat.
$456 - 414 = 42$ pounds of fat.

The remaining constituents are calculated for the 200 pounds of additional mix with the original percentages, thus:

$200 \times 0.15 = 30$ pounds sugar.
$200 \times 0.005 = 1$ pound gelatin.

The proportions of the additional ingredients necessary would, then, be as follows:

123.5	pounds of 34 per cent cream.
30	pounds of sugar.
10	pounds of 10 per cent gelatin solution.
36.5	pounds of skim milk.
200	pounds total additional mix.

2. CORRECTING A MIX HIGH IN FAT.

(*a*) Size of original mix, 3,600 pounds.

(*b*) Desired composition of original mix, fat 12 per cent, sugar 14 per cent, milk solids not fat 8 per cent, gelatin 0.5 per cent.

(*c*) Fat test of original mix, 13 per cent.

(*d*) The difference is 1 per cent fat, indicating an excess of 36 pounds of fat in the mix.

To correct the standardization with plain condensed (3–1) skim milk, sugar, etc., increase the size of the mix to 3,900 pounds and calculate the amount of each constituent that is needed in the new mix. The basis for adjustment is the same as before, i. e., the difference between the amounts of the respective constituents necessary for the new mix and the amounts contained in the original mix. For instance, the difference is 0 pounds of fat, 42 pounds sugar, 24 pounds milk solids not fat, and 1.5 pounds gelatin.

$3{,}900\times 0.12 = 468$ pounds of fat.
$3{,}600\times 0.13 = 468$ pounds of fat.
$300\times 0.14 = 42$ pounds of sugar.
$300\times 0.08 = 24$ pounds of milk solids not fat.
$300\times 0.005 = 1.5$ pounds of gelatin.

The proportion of the additional ingredients necessary would, then, be:

42	pounds sugar.
92	pounds condensed skim milk.
15	pounds 10 per cent gelatin solution.
151	pounds water.
300	pounds total additional mix.

3. CORRECTING A MIX LOW IN BOTH FAT AND MILK SOLIDS NOT FAT.

(*a*) Size of original mix, 3,600 pounds.

(*b*) Desired composition of original mix: Fat 12 per cent, sugar 13 per cent, milk solids not fat 10 per cent, gelatin 0.5 per cent, total solids 35.5 per cent.

(*c*) Fat test of original mix, 11 per cent.

(*d*) Total solid determination, 33.5 per cent.

(*e*) The difference in fat is 1 per cent, or a shortage of 36 pounds of fat.

(*f*) The difference in total solids is 2 per cent, but since the fat is 1 per cent lower than desired, it indicates that the solids other than the fat are 1 per cent too low.

(*g*) The amount of sugar added is then verified by checking the figures, and if these are found correct the difference of 1 per cent in total solids is attributed to a shortage of milk solids not fat.

To correct the standardization with 34 per cent cream, skim-milk powder, sugar, etc., increase the size of the mix to 4,000 pounds and proceed as explained in cases 1 and 2. The difference will be 84 pounds fat, 52 pounds sugar, 76 pounds milk solids not fat, and 2 pounds gelatin.

4,000 × 0.12 = 480 pounds of fat.
3,600 × 0.11 = 396 pounds of fat.
480 − 396 = 84 pounds of fat.
400 × 0.13 = 52 pounds of sugar.
4,000 × 0.10 = 400 pounds of milk solids not fat.
3,600 × 0.09 = 324 pounds of milk solids not fat.
400 − 324 = 76 pounds of milk solids not fat.
400 × 0.005 = 2 pounds of gelatin.

The proportion of additional ingredients necessary would, then, be:

247 pounds 34 per cent cream.
52 pounds sugar.
63 pounds skim-milk powder.
20 pounds 10 per cent gelatin solution.
18 pounds water.

400 pounds total additional mix.

The increase made in the size of the mixes is a matter that depends on the kind and composition of the ingredients used in making the adjustment and is usually kept as low as possible.

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